

The Inner Disk Structure: VLT/NACO and NICMOS/HST Observations

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Imaging of Young Disks

Motivation:

- Birth of Planetary Systems
- Disruption/Distortion of the Disks?

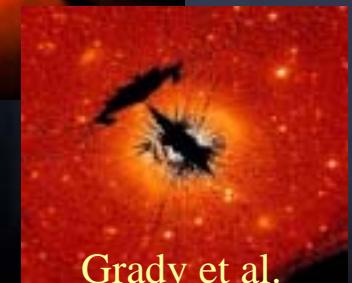


Chandra PR

Imaging study is Challenging:
High Contrast *and* High Resolution is Necessary

- Coronography
- Differential Polarimetric Imaging (Kuhn et al. 2001)
- PSF Subtraction

Weinberger et al.

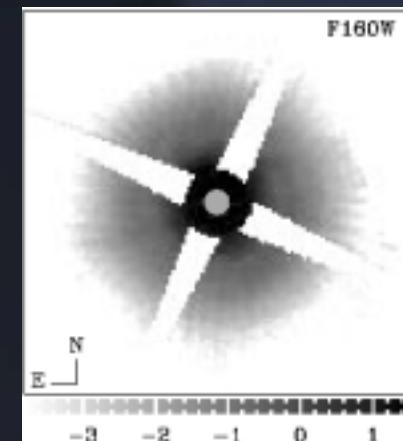


Grady et al.

TW Hya – Disk & Planet?

- TW Hya: most studied member of TW Hya association,
One the closest T Tauri stars at 56 pc

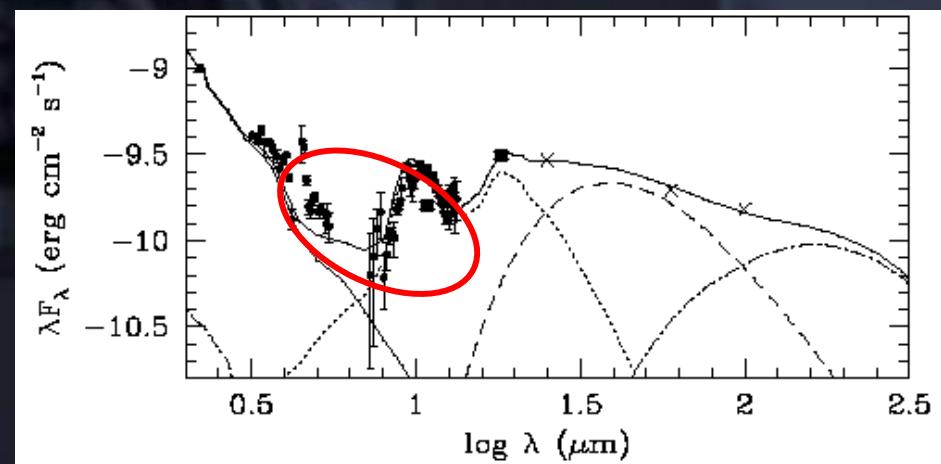
- Bright disk previously imaged 3" - 0.5"
(Krist et al. 2000, Trilling et al. 2001, Weinberger et al 2002)



Weinberger et al 2002

- Models: gaps, zones, structures
(Calvet et al. 2002, Krist et al. 2000)
Inner dark zone predicted

Coronographic Mask
Limits our view of the inner disk



Calvet et al. 2002

NACO/VLT

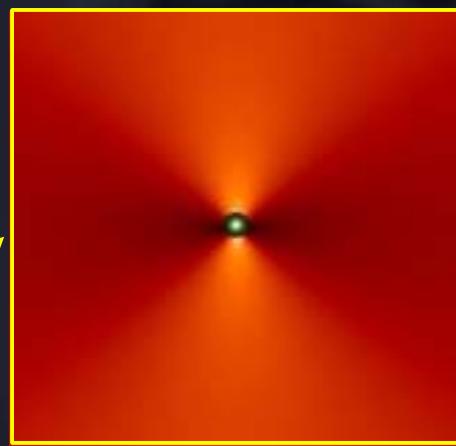
Our Goal: Trace the Scattered Light close to the Star

Differential Polarimetric Imaging

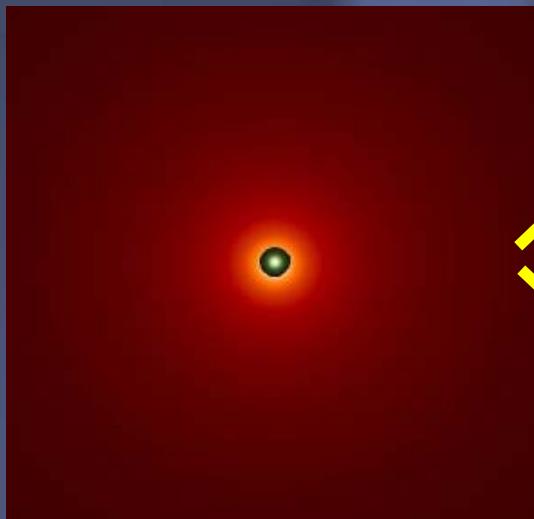
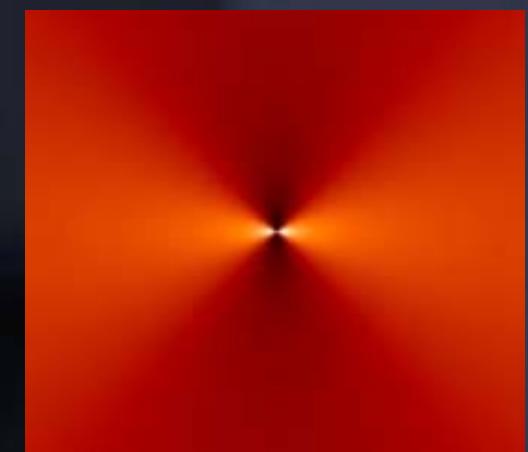
Source:

Polarized + Unpolarized

Ordinary Beam



Pol. Component

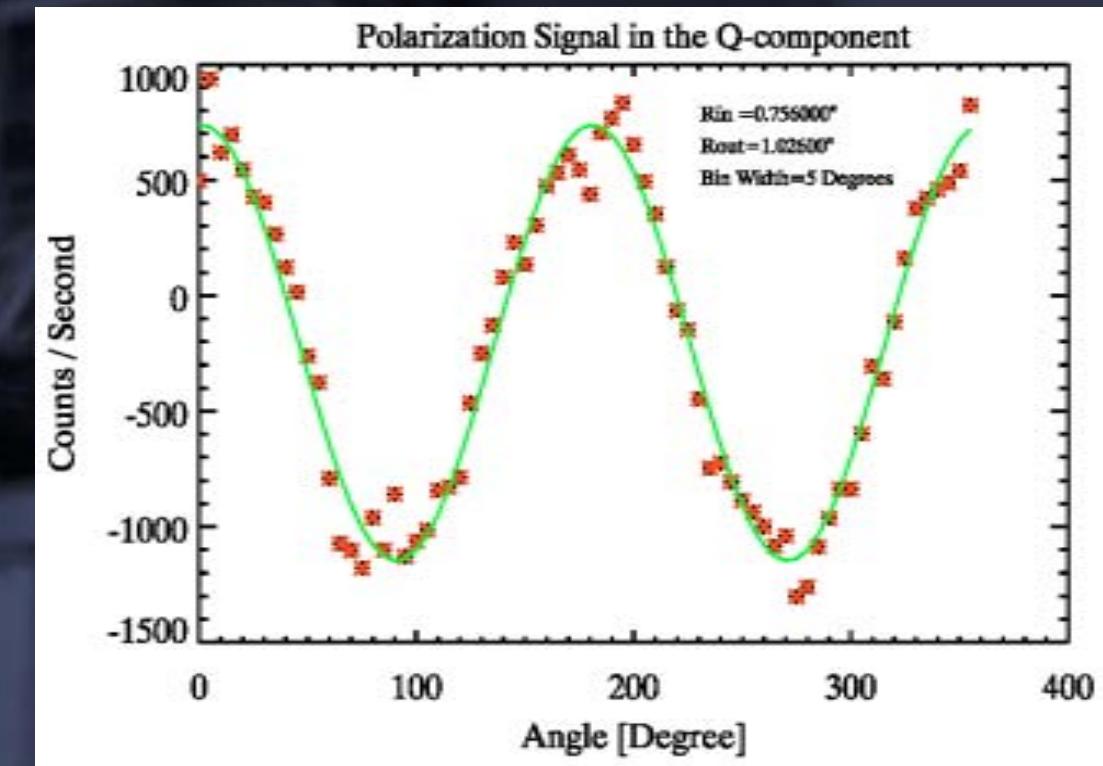
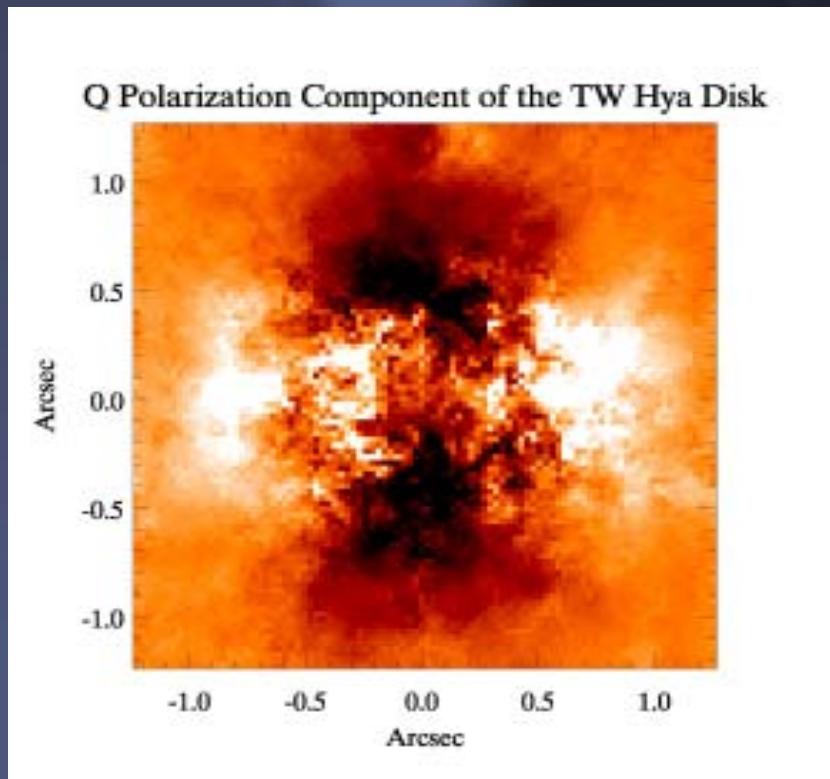


Extraordinary Beam

Kuhn, Potter & Parise 2001

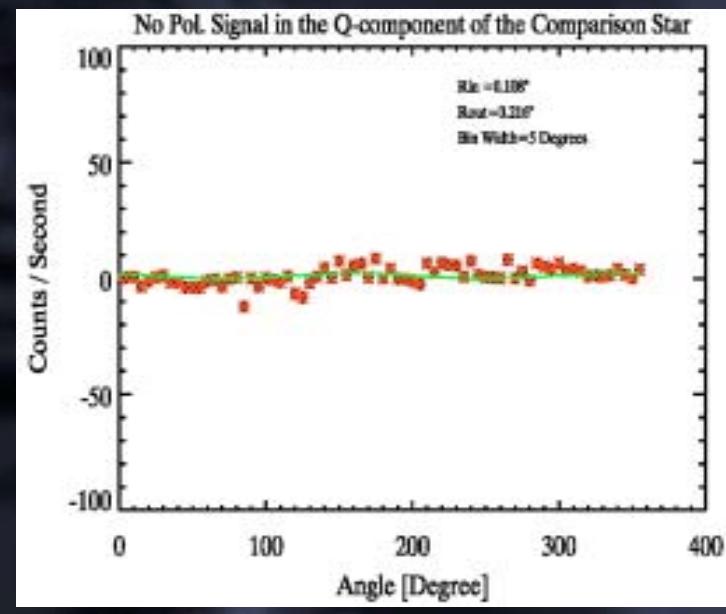
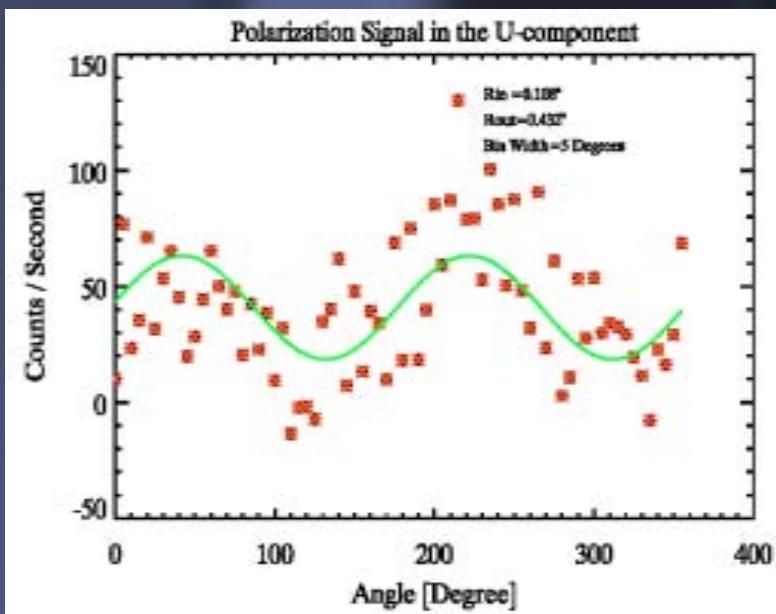
NACO DPI Results on TW Hya

Strong Polarization signal between 0.5" and 1.4" :



NACO DPI Results on TW Hya

Clear Polarization Signal between 0.1" and 0.4" - 6 and 24 AU



PSF Comparison star

0.1" -- closer than what is possible with present-day coronography!

Polarized Intensity Profile

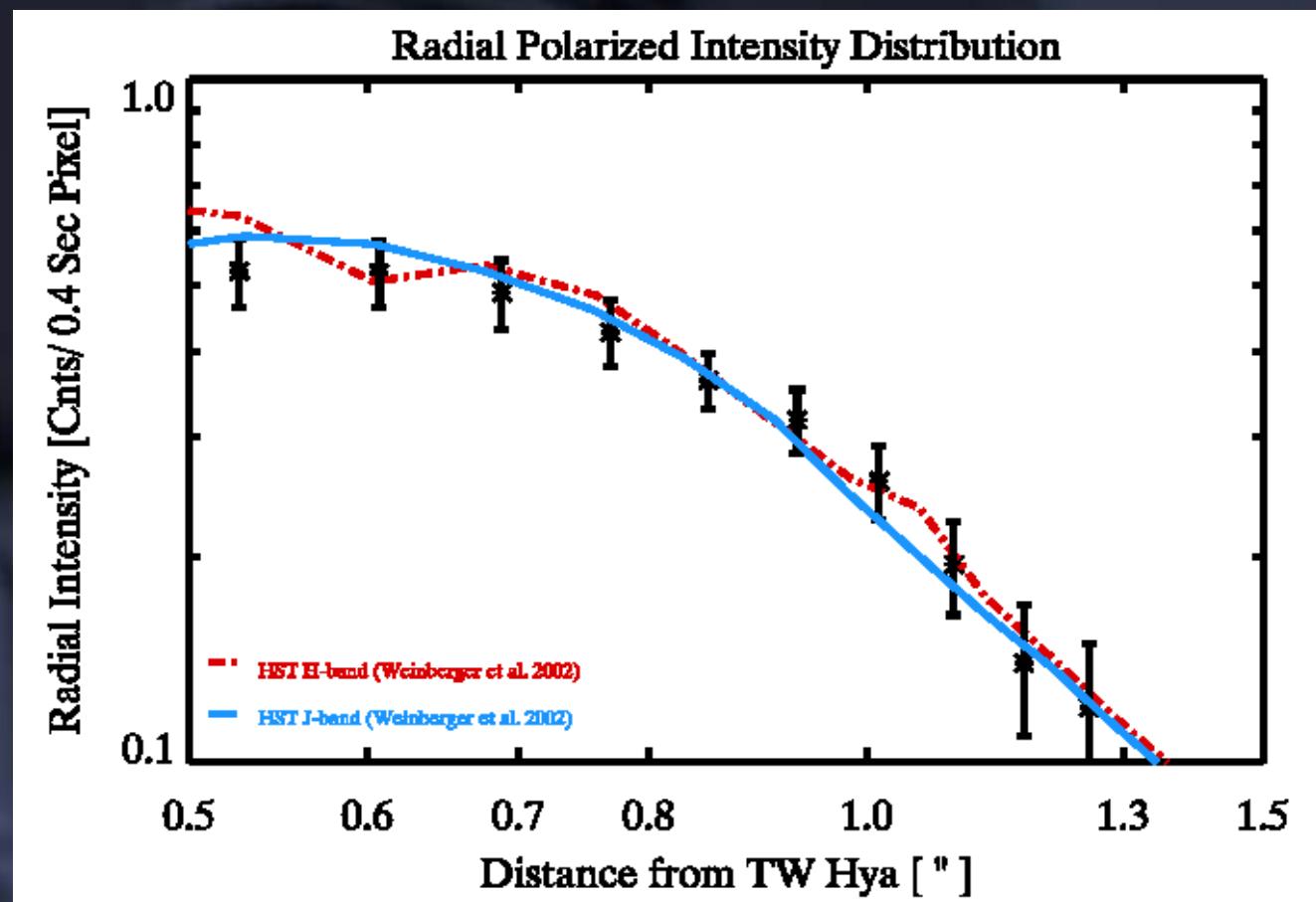
Polarized intensity profile between 0.5"-1.4"

- Gradual slope change at 0.8"

- Similar to the surface brightness profile by Weinberger et al. 2002

- Pol. Deg. is not changing strongly with radius

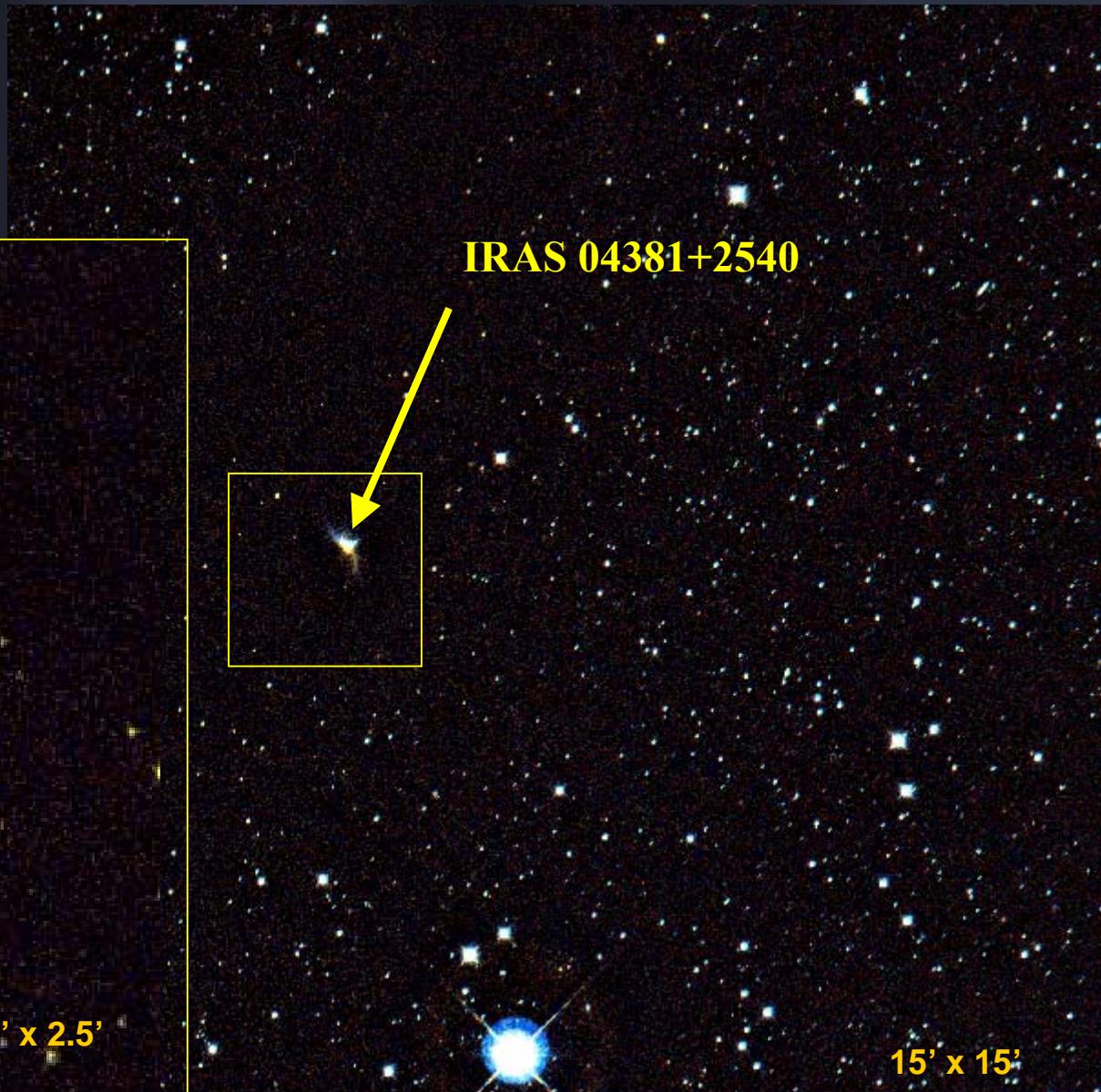
► Apai et al. 2004



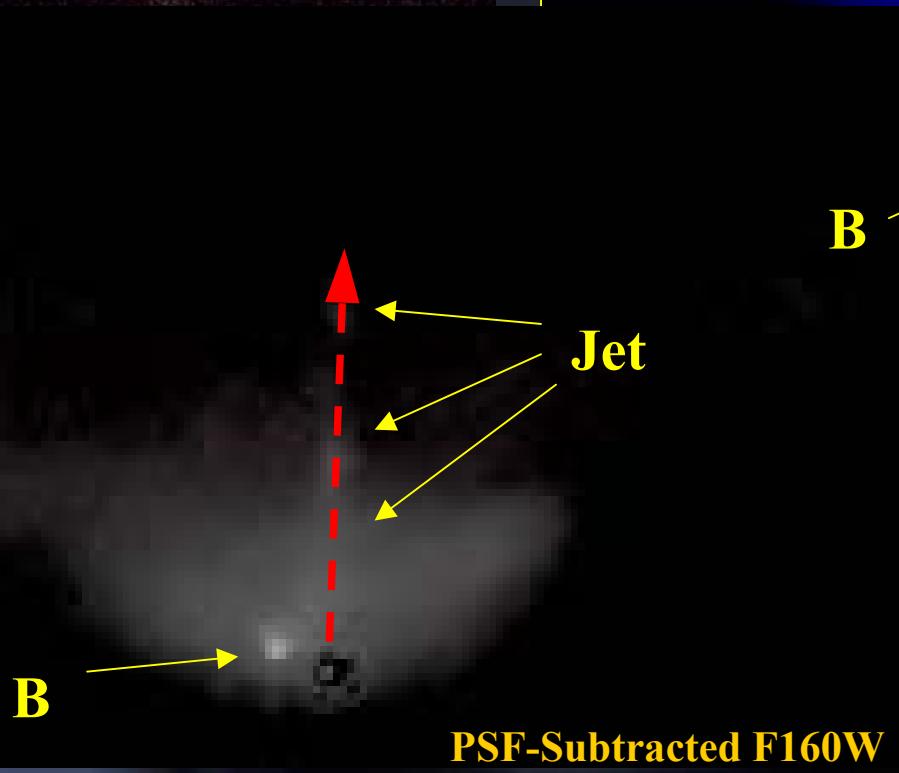
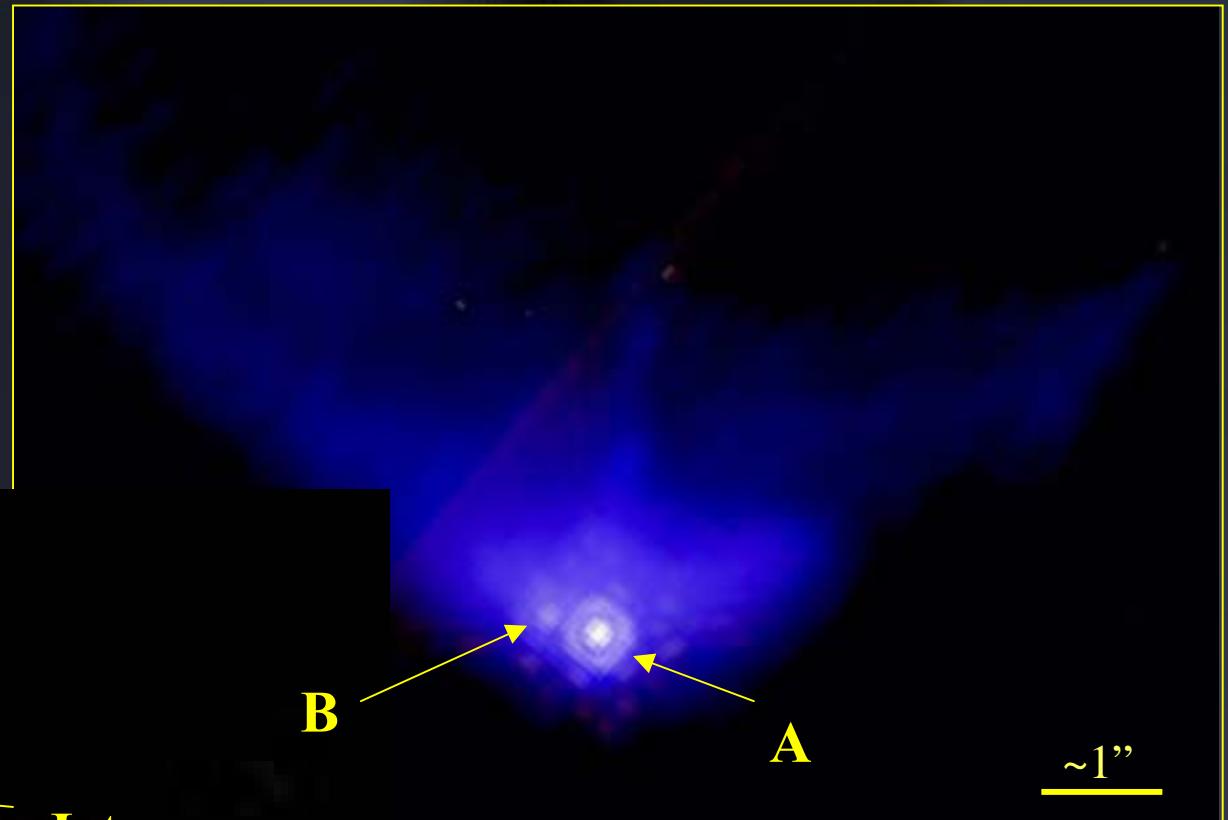
Ongoing work with new targets

Taurus Molecular Cloud – Omega2K

CO lines → dynamic mass
of $0.3 \pm 0.1 M_{\odot}$
(Brown & Chandler 1999)

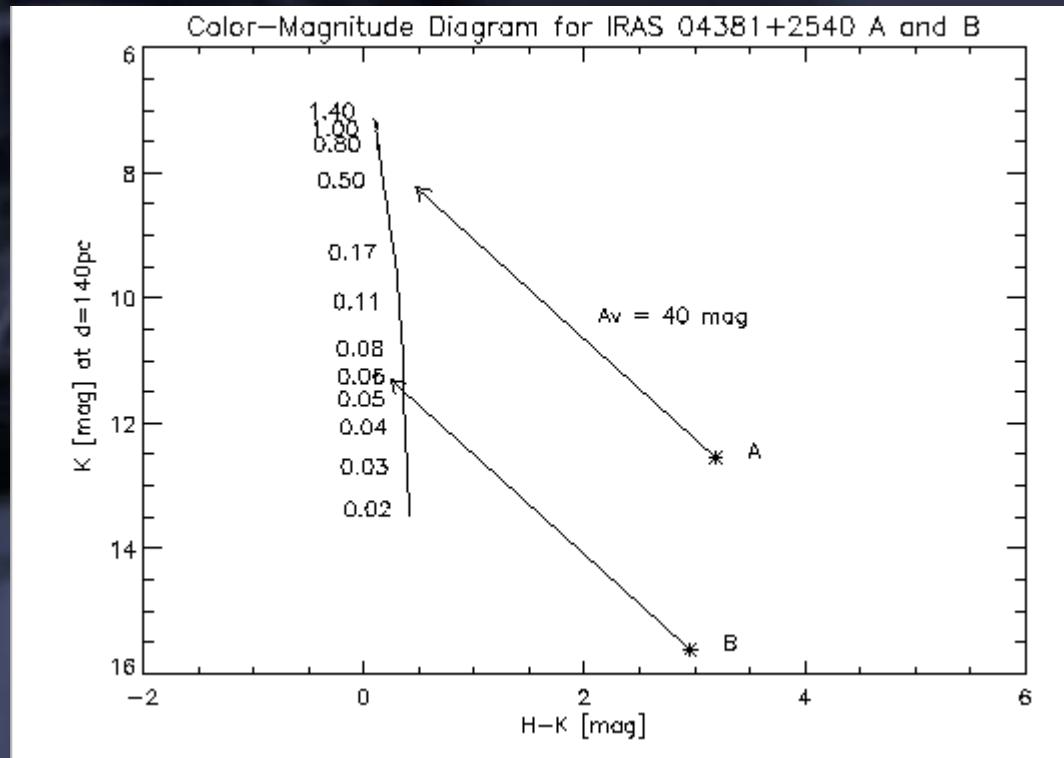
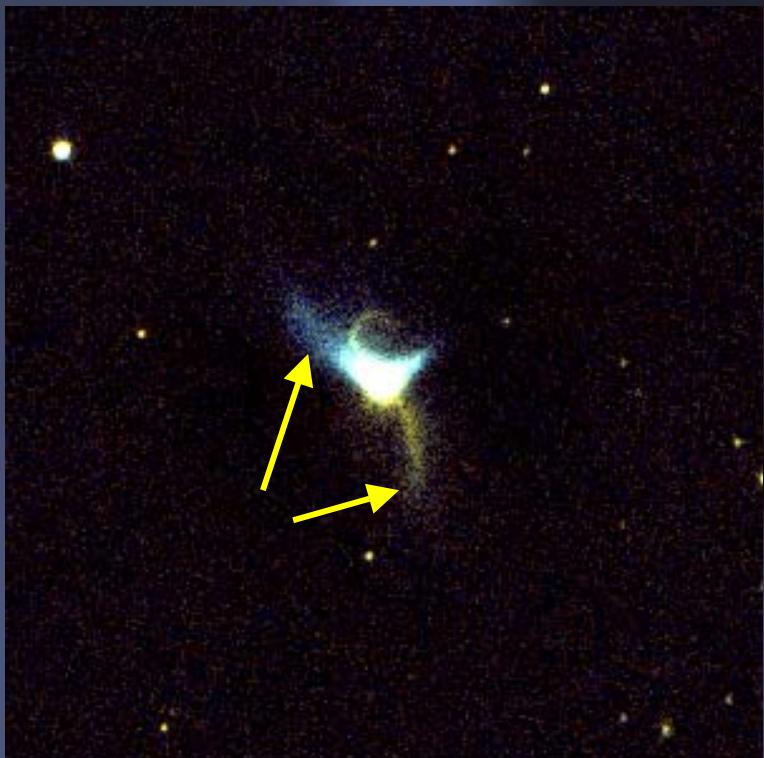


Taurus Molecular Cloud



Taurus Molecular Cloud

- Centrally symmetric perturbations at large scales?
Test case for perturbed circumstellar environments



Isochrones: Baraffe et al. 1998

- Faint & Very Low Mass Objects:
 - dynamic mass = total central mass
 - indications from the color-magnitude diagram

Conclusions

TW Hya:

- TW Hya Disk -Slope Change at 0.8"
 - Extends as close as $0.1''=6$ AU
- PDI + High Order AO is Highly Efficient for Disk Imaging

IRAS 04381:

- Very low mass companion
- Jet is originating from the primary
- Larger-scales dynamic perturbations?

NACO and Differential Imaging Polarimetry

Contrast Enhancement

Q

U

q

$$2 \text{ PI} = (Q^2 + U^2)^2$$

PI

TW Hya Long Q and U

Long PI

NACO Short Exposures

